DOCUMENT RESUME

ED 244 804 SE 044 529

AUTHOR Yeany, Russell H.
TITLE Research Implications for Allocations of Resources in Science Teacher Education.
PUB DATE 84
NOTE 12p.; Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (57th, New Orleans, LA, April, 1984).
PUB TYPE Viewpoints (120) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Administration; Curriculum Development; *Financial Support; Higher Education; Research and Development Centers; Researchers; *Resource Allocation; *Science Education; Science Teachers; Teacher Behavior; *Teacher Education
IDENTIFIERS *Science Education Research

ABSTRACT

This paper explores various issues related to the allocation of resources to science teacher education on the basis of research implications. Areas addressed include: (1) establishment of valid science teacher training content; (2) science teacher education research (providing information on the average effect of some general practices used to train science teachers); (3) the lack of a hypothesized or theoretical model as the focus on science teacher education research; (4) the practice of training researchers (suggesting that graduate science education programs need to be developed where research skills and methodology with emphasis on applying them are the core of the curriculum); (5) personnel administration; (6) external funding patterns; (7) national research centers (suggesting that resources be allocated to set up such centers to pursue a generic area of research); and (8) models related to translating theory (research results) into practice. It is indicated that research should be considered as a means to an end and not the end itself, and that this assumption should be kept in mind as discussions are made to fund, plan, conduct, and apply research. (JN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED244804

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
✓ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

RESEARCH IMPLICATIONS FOR ALLOCATIONS OF RESOURCES IN SCIENCE TEACHER EDUCATION

Russell H. Yeany

Science Education Research & Evaluation Laboratory
Department of Science Education
University of Georgia
Athens, Georgia 30602

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Russell H. Yeany
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Presented at the annual meeting of the National Association for Research in Science Teaching

New Orleans
1984

SE044529

RESEARCH IMPLICATIONS FOR ALLOCATIONS OF RESOURCES IN SCIENCE TEACHER EDUCATION

Any discussion of allocating resources to science teacher education on the basis of research implications must be anchored in three areas: First, curriculum development (as discussed by Dr. Renner); and, second, instruction/learning research (as discussed by Dr. Howe). Teacher or personnel training research adds the third dimension of implications to be considered. In addition, the broad picture of personal, local and external resources must be considered as we discuss issues related to allocations.

ESTABLISHING THE CONTENT

The curriculum and learning theory research should mold the content of a body of knowledge and skills to be acquired in a teacher training program. This content can be thought of as an analog to the knowledge and skills of science acquired in the college classrooms and laboratories. Unfortunately the curriculum and instruction/learning theory research has been slow in generating a definite knowledge base for training science teachers. Therefore any attempts to strengthen the effectiveness

of teacher training practices may suffer from weak research links along the lines of logic that we use to formulate and research sound training practices. An effective training practice targeted on invalid instructional procedures can be non- or counter-productive at the classroom level. Never-the-less we must move forward on all fronts and make adjustments in our training target skills and knowledge as information and new insights from other research dictate. Resources need to be allocated toward the establishment of valid science teacher training content.

SCIENCE TEACHER EDUCATION RESEARCH

There is a developing research base in science education which suggests a series of effective mechanisms for influencing teachers' behaviors. In a recent study, we (Yeany & Padilla, 1984) meta-analyzed the research literature in this area and found that the average effect size is 1.15. That is, the methods used to influence teachers in this research caused a 1.15 standard deviation shift, in the desired direction, of behaviors used by science teachers in clinical, laboratory and classroom settings. The following table provides more specific information on the average effect of some general practices used to train science teachers.

PRACTICE	NO. OF RESULTS	AVERAGE EFFECT SIZE	S.D
Study of Behavior Analysis Systems	14	.79	.55
Observing Models	44	1.10	--
Analyzing Models	101	1.15	--
Self Analysis	10	.72	.48
Analysis with Feedback	14	2.30	2.73
Microteaching (peers)	4	.72	.35
Microteaching (students)	6	.81	.52
OVERALL	193	1.15	--

As can be noted, teaching behaviors can be influenced by systematic training. The practices and behaviors targeted in this research were the ones generally supported as those desired in a classroom context. They include wait-time, questioning level and strategy, explanation, focusing (through objectives and organizers) and inquiry techniques; all the things looked for in a good science teacher. So, what is the problem? All of the methods generate positive (and large) effect sizes on desirable and sought after behaviors.

THE MISSING PARADIGM

The problem is that the research with its results are piece-meal; and, even though they suggest at least a skeleton of an acceptable training model, no hypothesized or theoretical model has been the primary focus of any of the research. All of the research has been guided by a single (or a few) desired outcomes. To this extent the research on instruction/learning is driving the training research. This is not disastrous; but, by employing (or falling into) this strategy, we fail to generate a structural paradigm to guide both our training and research activities.

Why do we continue in this direction? The answer to that is two-fold. First, comprehensive empirical inquiry into a model as complex as that involved in science teacher training is a mammoth and demanding undertaking which requires time, energy and resources not normally invested in such ventures. Secondly, a new approach to science education research is called for to carry out such an effort. How should we allocate resources toward this effort?

TRAINING RESEARCHERS

First, we need to examine the practice of training science education researchers, which is a weak process. For the most part, the research training and experiences are ancillary to a host of other priorities. Nobody majors in science education

research. This is a mistake! The profession is lacking a critical mass of individuals who work with state of the art skills at the cutting edge of educaional problems. Many graduate programs are doing nothing to rectify this situation.

Graduate science education programs need to be developed where research skills and methodology with emphasis on applying them are the core of the curriculum. Science content courses beyond the undergraduate level (or maybe masters) should be deemphasized or even discouraged. Time, energy and brain cells should be spent on molding a scholarly researcher and not on producing a jack-of-all trades but master-of-none individual. Research would be seen by the research major as an intrinsic function and not as an extrinsic ancillary activity.

Some changes in procedures for identifying and training these researchers are called for. The selection process needs to be based on predictor variables and rigorously applied. Recuriting and career counseling activities would be in order. A large percentage of formal training should be conducted in structured research internship where the student joins an on-going research effort early in the curriculum. This type of program should include functioning levels of interns from first-year through post doctoral students.

Not every institution can or should deliver a full-blown science education research major. This is neither needed or desirable. A policy of entrenchment should be followed where a number of geographically distributed universities are encouraged (or accept the responsibility) to secure the resources, assign and recruit faculty, and develop a curriculum to train cutting edge

researchers. There is a "chicken and egg" problem inherent to this idea. Presently, few institutions have the faculty with the interest or skills to deliver such a program. To overcome this, a new look at staffing is called for. More use needs to be made of cross-staffing from ed. psyc, psyc, sociology, etc. In addition, visiting (long term) and adjunct appointments will be needed.

The above proposal does not mean that every program should not include some emphasis on research. All should. It is more a matter of degree of focus.

PERSONNEL ADMINISTRATION

Another area to be examined are present methods of staff utilization which are not condusive to long-term high quality research productivity. Research is always a secondary or nonassigned faculty activity. Sort of like student advisement, it comes with the job. Administrative decision making and expectations should be changed to promote research as a primary activity for some faculty positions. This would promote sustained research efforts into problems not addressable by short-term, low intensity efforts.

Under the present system, research efforts are scattered hither and froe as faculty attempt to allot their energies across an unproductive set of duties including teaching multi-types of courses, (e.g., science content, teacher training, graduate professional, graduate research) student advisement, student research problems and other generic institutional activities.

Faculty research interests can ususally only be partically pursued through doctoral students dissertations. The packaging of

these efforts into time and product constraints serves as a severe restriction on the researcher and leads to piece-meal efforts. Combining the suggestions made under the training of researchers with a new approach to staffing would lead to better research products. More opprotunities are needed where the student plugs into the faculty research and not vice versa.

EXTERNAL FUNDING

We also need to examine funding patterns. Science education research does not have a long history of external funding. But, the short-lived efforts of the 70's were largely unproductive. The monies were distributed through a system of catch-phrases and issues rather than one based on research problems. The aspiring fundee was forced to internalize a matrix with labels such as "middle school", "handicapped", "minority" or "women" in order to have a research proposal considered. Thus, the game of grantmanship prostituted the research (and the researcher) from the start. This is an intolerable and unproductive position.

In addition, funding in large amounts was attracted by appealing designs representing status studies incapable of producing directly applicable results. This is a case where the means overshadowed the product.

If the practice of supplying significant external funds for science education research is rekindled, the monies should be directed toward specific research questions related to generic classroom and/or teacher training problems and not be used to solve popular issues or currently vogue but ambiguous catch terms.

Resources should be directed at solutions and not at biases. Likewise, the design of a study should not be the focus of funding decisions. Research designs are meant to serve the question, and should be the slave of the problem, not vice versa.

NATIONAL RESEARCH CENTERS

In order for science education research to be more effective, it must be raised to a primary level and command the undivided and sustained attention of a significant number of researchers. For this to occur, the allocation of resources toward this goal should not be scattered. Scattering will produce more piece-meal results and will not generate the broader structure needed to guide science teacher training. The gathering (unscattering) of these resources should begin at the institution level. Universities should identify science education research faculty and recognize them though the allocation of resources to pursue research as a primary effort. Funding agents which support educational research (e.g., the NSF) should also concentrate their resources toward the creation of centers or laboratories for science education research and evaluation.

A Science Education Research and Evaluation Lab should be set up to pursue a generic area of research (e.g. teacher preparation or classroom strategies). Healthy overlap or redundancy between Labs could be built in; but, a comprehensive overall effort should be sought. That is, the sum of all the efforts across all the

Labs should reflect the total definition of the science education effort.

APPLICATION OF RESEARCH

For many years science educators have voiced a concern related to the translation of theory (research results) into practice. Most have said that the researcher needs to write for the practioneer (teacher), probably in the form of "What Research Says to the Science Teacher". This model is somewhat absurd. For too long, we have been expecting things from teachers which they are not going to do. We need to look at other models. Industry, for example, does not expect the line-worker to implement the latest engineering or research developments in production. Some intermediate authority is responsible for this action. Line-workers are trained and then expected to perform accordingly. These intermediate authorities in science education could be supervisors or master teachers. Resources need to be allocated to assist these persons in implementing research.

Another change needed in the application of research results is related to product development (e.g., curriculum materials). Here we should follow a medical model. Instead of basing development and implementation almost solely on marketing research. We need to require effectiveness evidence. The educational treatment prescribed for our students should be submitted to the same scrutiny required of our medical treatments, no less. More resources need to be allocated to produce evaluation efforts.

CONCLUSIONS

At this point in our evolution of a discipline of science education, research should be considered as a means to an end and not the end itself. This assumption should be kept in mind as discussions are made to fund, plan, conduct and apply research. Even though research practices should be viewed as means to loftier ends, these means should receive paramount status in regard to funding, training and personnel assignment.

I believe that such an allocation of resources in science education can lead to the production (or discovery) of paradigms that will lead to a more cost and effort efficient return on future allocations in our profession.

INSTITUTING THE CHANGE

Change in our science education research practice is possible but not painless or easy. Some have suggested that we respond as if in a "crisis" situation. I caution against this concept of our position. A real crisis can cause one to be reactive, a model which is not always corstructively productive. I would rather that we operate from a proactive mode where we can be more in control and more constructive. The pendulum of public opinion is swinging in our direction. Let's make use of its inertia in a proactive mode.